EFFECT OF ECCENTRIC RESISTANCE TRAINING WITH AEROBIC EXERCISE ON LIPID PROFILE IN YOUNGER ADULTS

- AN EXPERIMENTAL STUDY

Dissertation submitted to The Tamilnadu Dr. M.G.R. Medical University towards partial fulfilment of the requirements of MASTER OF PHYSIOTHERAPY (Advanced PT in Cardio Pulmonary Diseases) Degree Programme.

KMCH COLLEGE OF PHYSIOTHERAPY

(A unit of Kovai Medical Centre Research and Educational Trust)

Post Box No. 3209, Avinashi Road,

Coimbatore – 641014.

2010-2012

CERTIFICATE

CERTIFICATE

This is to certify that research work entitled **"EFFECT OF ECCENTRIC RESISTANCE TRAINING WITH AEROBIC EXERCISE ON LIPID PROFILE IN YOUNGER ADULTS" – An Experimental study** was carried out by the candidate bearing the Register No:**27101613**, KMCH College of Physiotherapy towards partial fulfillment of the requirements of the **Master of Physiotherapy (Advanced PT in Cardio Pulmonary Diseases)** of the Tamil Nadu Dr. M.G.R. Medical University, Chennai-32.

PROJECT GUIDE

Mr.U. NAMBIRAJA, M.P.T ,
Associate Professor,
KMCH College of Physiotherapy,
Coimbatore-641014.

PRINCIPAL

Dr. EDMUND M D'COUTO,
MBBS.Dip.Phy.Med& Rehab
KMCH College of Physiotherapy
Coimbatore-641014.

INTERNAL EXAMINER

EXTERNAL EXAMINER

Project Evaluated on:

ACKNOWLEDGEMENT

ACKNOWLEDGEMENT

First and foremost I am happy to express my sincere and heart full thanks to the **'GOD ALMIGHTY'** for his blessings to complete this project work

I'm deeply indebted to **My Beloved Parents and Sister** for their unconditional love, sincere prayers, encouragement, constant inspiration and care without which I would not have accomplished anything.

My sincere thanks to the KMCH Management, especially to the Chairman **Dr. Nalla G. Palaniswami** M.D. (AB), and the Trustee **Dr. Thavamani D.Palaniswami** M.D. (AB) F.A.A.P., who are the stalwarts of the institute.

I thank **Dr. O.T. Bhuvaneswaran** Ph.D, Chief Executive Officer, for his intensive efforts towards the academics.

My sincere thanks to **Dr. Edmund M D'Couto**, M.B.B.S. ,D.Phys. Med & Rehab, Principal, KMCH College of Physiotherapy, for his valuable support.

I express my heartiest thanks in this instance to my project guide

Mr. U. NAMBIRAJA, M.P.T (Cardio), for his benevolent guidance, support and valuable suggestions throughout the course of the study.

My heartfelt thanks to my class in-charge **Mrs. A. Brammatha, M.P.T. (Neuro), P**rofessor for her guidance and encouragement throughout the study.

I sincerely thank **Mrs. A.P Kalpana, M.P.T.(Cardio)**, **Vice principal**, for her generous support and encouragement.

I extend my gratitude to **Mr. K. Venugopal, M.A., M.Phil**, Professor in Research & Biostatistics for letting me know the intricacies of Biostatistics.

I wish to express my thanks to all **the faculty members** for their support.

I perpetuate my thanks to librarian, **Mr. P. Dhamodharan** and his fellow members for their co-operation and patience in providing books for reference, which helped me to complete this project successfully.

I express my hearty thanks to all my **subjects** for their active participation and co-operation.

Last but not the least I would like to express my hearty thanks to all my **classmates and friends** for their active participation and co-operation without which this study would not have progressed to be successful.

CONTENTS

ABSTRACT

ABSTRACT

OBJECTIVE: To find out the effect of eccentric resistance training with aerobics exercise on blood lipid profile among younger adults.

STUDY DESIGN: pre-test post test experimental study design.

METHODS: 30 subjects who fulfilled the inclusion and exclusion criteria were selected through purposive sampling technique and were assigned into two groups. Group A and Group B. The group A consists of 15 subjects performed eccentric resistance training with aerobic exercise and the group B performed aerobic exercise only. Lipid profile was measured by hematological investigation. The scores were taken before and after 6 weeks of training

RESULTS: The statistical analysis was done using paired‘t’ test between pre test and post test values of both the groups. At 5% level of significance the result showed improvement in Total cholesterol, HDL, LDL in group A. There is no significant improvement in group B. Independent‘t’ test between post values showed significant improvement in HDL, LDL level in the blood

CONCLUSION: It can be concluded that eccentric exercise with aerobic exercise has greater benefit on lipid level in the blood.

KEY WORDS: Eccentric resistance training, aerobic exercise, lipid profile, VLDL-Very low density lipid, HDL-High density lipid, LDL-Low density lipid, Triglycerides,

INTRODUCTION

1. INTRODUCTION

Cholesterol and triglyceride constitute the lipid particles of the body. These lipids are transported in the blood in complexes known as lipoproteins .The main classes of lipoprotein are VLDL, HDL, LDL, triglycerides. LDL (Bad cholesterol) particles carry the majority of the cholesterol to the cells. HDL (Good cholesterol) removes cholesterol from the tissues and returns it to the tissue.

Hyperlipidaemia is the condition in which abnormality in the lipid profile, encompassing a variety of disorders relating to elevations in total cholesterol, LDL or triglyceride and lower levels of HDL. Hyperlipidaemias are divided into primary and secondary sub types. Primary hyperlipidaemia is usually due to genetic causes, while secondary hyperlipidaemia arises due to other underlying causes such as Diabetes. Lipid abnormalities are common in the general population, and are regarded as a modifiable risk factor for cardiovascular disease.

Hyperlipidaemia is a growing worldwide disease with epidemic dimension. It affects large number of persons from wide range of group and all the social and economical levels throughout the world especially India.

Over the last 40 years there have been dramatic changes in the human environment, behavior and life style .These changes have resulted in increased rate of obesity and metabolic disorders. The lack of physical activity in daily life induces obesity and increased risk of hypo kinetic diseases, diabetes mellitus, hypertension, hyperlipidaemia, heart disease etc. Over the next decade the epidemic of hyperlipidaemia will continue to escalate.

Elevated levels of serum cholesterol as well as low levels of HDL cholesterol along with hypertension and smoking are the major risk factors for cardiovascular disease. Hyperlipidaemia is a primary risk factor for the development of atherosclerosis. With increasing cholesterol concentration, there is a increased risk of coronary heart disease. It also affects myocardial contractility, excitability and conduction properties independently in the absence of atherosclerosis.

It is indicated that a 1% reduction in a person's total serum cholesterol level yield 2 to 3 % reduction in the risk of coronary heart disease. It appears that physical activity will reduce serum cholesterol levels when there is a corresponding decrease in the percentage of body fat.

Physical activity includes aerobic and resistance exercise programs.Aerobic exercise comprises as walking, jogging and aerobics helps to reduce total cholesterol level, low density lipoprotein cholesterol and triglycerides while elevating the good high density lipoprotein cholesterol.

Aerobic training increases energy expenditure by activation of lipolysis .Therefore aerobic training affects the reduction of body weight and body fat, where as resistance training affects the maintenance or increase in lean body mass. Resistance exercise is beneficial, since it decreases the blood pressure, total and intra-abdominal fat and produces substantial increase in the strength, mass, power and quality of skeletal muscle and lowers insulin resistance.

Combined aerobic and resistance training is the best program to treat obesity and to reduce body fat. Generally the resistance training is given in the form of concentric, eccentric and isometric forms. Most resistance program includes dynamic repetition with concentric and eccentric action.

Basically the eccentric exercise involves putting tension on the muscle, as it opposes the stronger force which causes the muscles to lengthen as it contracts. Commonly this training is used in stroke, Parkinson's and multiple sclerosis patients. Eccentric exercise is an exercise modality and is well applicable in sedentary individuals.

Very few studies have evaluated the relationship between aerobic plus eccentric resistance exercise and risk factors for cardiovascular disease, and they have focused mainly on elderly people.

Although high cholesterol is not often found in young children, it may begin to develop in adolescents or young adults either as an inherited condition or through unhealthy eating habits and can continue into childhood, creating potentially serious health problems.

1.1. NEED FOR THE STUDY

In the world of literatures, there are number of studies with huge amount of explanations, why there is decrease in lipid level following exercise.

Many studies have stated that the aerobic training helps in reducing lipid levels in blood. Eccentric resistance training also helps to reduce the blood lipid level.

This study aims to find out the effect of eccentric resistance training with aerobic exercise on lipid profile.

REVIEW OF LITERATURE

2. REVIEW OF LITERATURE

The review of literature is to understand the accentuated knowledge about the topic being reviewed.

2.1. DEFINITION

- **Prep manual 3rd edition[57],** these lipids are transported in the blood in complexes known as lipoproteins.
- **Davidson's principles and practise of medicine 19th edition[15]:** Hyperlipidaemia is the condition in which abnormality in the lipid profile.
- **Fedrickson (1970)[47],** introduced a classification of the primary hyperlipidaemias.

2.2. CAUSES OF HYPERLIPIDAEMIAS

- **Davidson's principles and practise of medicine 19th edition[15],** primary hyperlipidaemia is usually due to genetic causes, while secondary hyperlipidaemia arises due to other underlying causes such as Diabetes.
- **Rita patutana[59] (2008),** has said the risk to develop metabolic syndromes as Hereditary factor, dietary factor, excessive weight, sedentary life style, stress factor, smoking and age.
- **Fletcher GF,et al [26] (1995),** concluded that the lack of physical inactivity in daily life induces obesity and increased risk of diabetes mellitus, hypertension, heart disease etc.

2.3. Pathology for hyperlipidimia.

- **Davidson's principles and practise of medicine 19th edition[15],** primary hyperlipidemia is usually due to genetic causes, while secondary hyperlipidaemia arises due to other underlying causes such as Diabetes.
- **Jeffrey Janot,M.S and Len Kravitz,Ph.D (2003)[34],** in type II diabetes mellitus the specialized cells are able to produce insulin, but the insulin is ineffective at helping the blood sugar to enter the body tissue for producing energy. Glucose will get converted into lipid.

2.4. Risk factors

- **Friedman (1969)[3],** the major risk factors for cardiovascular disease include hypertension, smoking, and elevated levels of serum cholesterol as well as low levels of HDL cholesterol. With increasing cholesterol concentration, there is an increased risk of coronary heart disease.
- **Conroy R.M et al[23],** defined major risk factors for cardio vascular disease include hypertension, smoking and elevated levels of serum total or LDL cholesterol as well as low levels of HDL cholesterol.
- **Castelli WP [55](1984),** suggested that hyperlipidaemia is a well documented risk factor for cardiovascular disease.
- **Adner MM et al [5], Lamarche B et al,** found out that low concentrations of total serum cholesterol and low density lipoprotein cholesterol and low body fat percentage are associated with decreased cardiovascular disease morbidity and mortality.

2.5. EXERCISES

- **Lamarche B(1992),[26] Blumenthal JA et al (1991),** it suggested that regular physical activity has been shown to improve lipid and glucose metabolism by increasing insulin sensitivity and serum HDL cholesterol and decreasing serum LDL cholesterol and triglycerides.
- **Gordom PM,[27] Gross FL et al (1994), Berger GMB, Griffith MP et al (1987),** concluded that acute exercise has also been shown to improve lipid profiles.
- **Campbell (1966)[74],** concluded that Physical activity will reduce serum cholesterol levels.
- **David K mcculloch[17] (2008),** stated that Exercise is beneficial to all individuals, Exercise promotes cardiovascular fitness and weight loss, lowers blood pressure, improves lipid profiles, and improves blood sugar level.
- **Baraz et al[6] (1994),** explained the benefits of exercise.
    - ✓ Exercise lowers serum glucose
    - ✓ Exercise augments insulin effect
    - ✓ Exercise reduces heart diseases and stroke risk
    - ✓ Increases HDL

- ✓ Lowers LDL
- ✓ Lowers total cholesterol
- ✓ Decrease blood pressure

- **Thomas et al (1995)[67],** explained that exercise significantly improves glycemic control and reduces visceral adipose tissue and plasma triglycerides.
- **Hedden and Boule[28] (1998),** proposed that exercise plays an important role in reducing cholesterol level and weight in type –II diabetes.

2.6. AEROBIC EXERCISE

- **Angelopoulos TJ[27], et al (1993),** found favourable changes in triglycerides have been reported in men after acute aerobic training.
- **Jason J.Winnick, W.Michael Sherman [32](2007),** concluded that aerobic exercise was beneficial to improve whole body insulin sensitivity and improving lipid profile.
- **Lindsstrom[46] et al (2001),** suggested that walking can be safely performed and recommended as an adjunct therapy to diet treatment in obese patients.
- **Thomas H.Marwick,[68] MD, PhD, chair, Matthew (2009),** found out that beneficial effects have been reported over shot durations. Improvements in arterial stiffness and insulin resistance have been documented only after three weeks of aerobic exercise training.
- **Isabel C.D. Ribeiro,RodrigoT [31] (2008),** conducted a study on subjects with type 2 diabetes mellitus .4 months aerobic training compared with a group of sedentary subjects .It states that aerobic exercise training in diabetes mellitus improved the HDL efficiency against LDL oxidation and favoured HDL maturation.
- **Adria[2]Giacca et al (1998),** showed that plasma glucose level declined during walking.
- **Carol Birch[12] (2004),** concluded that walking is effective in lowering blood glucose level Regular walking will increase insulin sensitivity thereby decreasing blood glucose and increasing carbohydrate metabolism.

2.7 ECCENTRIC EXERCISE TRAINING AND AEROBICS

- **Wood R,[76] Reyes R, et al (2001),** resistance training is found to be beneficial in older persons.
- **Halbest[29] JA, Silagyc et al (1999), Hurley BF, Roths,** the study shows the effect of resistance training on serum lipids is inconsistent.
- **Szapary et al[29] (2003),** found that resistant training reduces LDL cholesterol level.
- **Hill et al[30] (1987),** combined aerobic and resistance training is best program to treat obesity and reduce fat percentage of body.
- **Alexandria[1] (2008),** conducted study on patients with diabetes who participated a program combining aerobic and high force eccentric resistance exercise and demonstrated improvement in glucose control, physical performance and body fat composition.
- **Drexel, H[20] (2008),** has stated that eccentric endurance exercise is less strenuous than concentric exercise. Eccentric exercise is the exercise modality with favourable metabolic and anti inflammatory effects and is well applicable in sedentary individuals.
- **S. L. Lindstedt[62] ,P.C LaStayo and T.E Reich (2001),** has mentioned that much greater force can be produced eccentrically than concentrically, it has the capability of over loading the muscle, the goal of resistance strength training. Force of this magnitude is only possible during eccentric contractions.
- **Matthew D[51] Hordern, Ph. D (2009),** suggested that resistance training should be encouraged, and should be moderate to high intensity-2 to -4 sets of 8- to- 10 repetitions at a weight that can't be lifted more than -8 to 10 times, with -1 to -2 minutes rest periods in between sets.
- **Jeffrey Janot,M.S[34] (1988),** has prescribed eccentric resistance training for type 2 diabetes mellitus, with a frequency of at least 3 times a week up to five times a week .Intensity;40 – 60 % of max HR and time 30 to 60 minutes.
- **Paul LaStayo,PT,PhD[44,] (2008),** has proved that eccentric resistance exercise program was specifically designed to increase strength and muscle mass ,using a recumbent stepper that produced a lengthening contraction, such as when lowering the dumbbell in a biceps curl.

- **Dr.Robin Marcus[60] (2008),** conducted a study with type 2 diabetes mellitus .In the study half the participants did aerobic exercise and other half did aerobics exercises with resistance training .After 16 weeks of exercising at three times per week , the group that incorporated resistance training had an improved overall body mass index including leaner thigh muscles.
- **Balter et al[7] (1988),** aerobic training affects the reduction of weight and body fat, where as resistance training affects the maintenance or increase LBM.
- **Soukup et al[63],** stated that resistance training improves blood cholesterol profile, increases heat function, improves insulin sensitivity, decreases blood glucose level. It also improves muscle strength, power and endurance.
- **Darcy J Cuff[16] (2003),** concluded that resistance training induce muscle mass development. Muscle mass lost with aging, therefore it is particularly important in elderly population .The training program that combines both aerobics and resistance training may be most advantageous because they combine different mechanisms of action.
- **Marcus[60] (2008),** stated that as people age they lose muscle mass and subsequently, mobility, resulting in greater risk of falls. Adding resistance training to the regimen leads to improved thigh lean tissue which in turn may be an important way for the patients to increase resting metabolic rate, exercise tolerance and functional mobility.
- **Kirwan[40] and Del Aguila (2003),** distinction between concentric and eccentric exercise Eccentric exercise is characterized by the muscles lengthening as the tension drops. Eccentric exercise causes muscle damage, muscle soreness, edema, and elevation of plasma myocellular proteins.
- **William E.Kraus[74], MD and Benjamin D. Levine, MD, (2007),** conducted study with 251 adults ,between age group 39 to 70 who were not exercising regularly and had type 2 diabetes. Both the aerobic and the resistance training group had twice as much improvement in blood glucose level.
- **EA Gulve.PhD[22] (2008), stated** that aerobic exercise is recommended for its beneficial effects on glucose control as well as its abilities to retard the progression of other co morbidities such as cardiovascular disease. The glucose lowering effects of resistance training has additional benefits on sarcopenia.

AIMS & OBJECTIVES

3. AIM AND OBJECTIVES

3.1. AIM

- To evaluate the effect of resistance training with aerobic exercise on Total cholesterol, HDL, LDL, VLDL and triglycerides (lipid profile).

3.2. OBJECTIVES

- To determine the effect of aerobic exercise on lipid profile.
- To determine the effect of aerobic exercise with eccentric resistance training on lipid profile.

MATERIALS & METHODOLOGY

4. MATERIALS AND METHODOLOGY

4.1. STUDY DESIGN

- Pre test and post test experimental study design.

4.2. STUDY SETTING

- Kovai medical centre and Hospital l(KMCH HOSPITALS),Coimbatore.

4.3. SAMPLING METHOD

- Purposive sampling method.

4.4. SAMPLE SIZE

- Total 30 Subjects.
- Experimental group- 15 subjects (GROUP A).
- Control group -15 subjects (GROUP B).

4.5. STUDY DURATION

- 6 weeks of training for each person.

4.6. CRITERIA FOR SELECTION

4.6.1. INCLUSION CRITERIA

- Age 20 to 30 years.
- Males.
- Total cholesterol level less than 250 mg/dl.

4.6.2. EXCLUSION CRITERIA

- Coronary artery disease
- Respiratory disease
- Orthopaedic disease
- Smokers
- Alcoholic

- Thyroid problems
- Type-1 Diabetes Mellitus
- Type -2 Diabetes Mellitus

4.7. HYPOTHESES

✓ 4.7.1. NULL HYPOTHESIS

- **H_{01}-** There is no significant effect of aerobic exercise on lipid profile in younger adults.
- **H_{02}-** There is no significant effect of resistance training with aerobic exercise on lipid profile in younger adults.
- **H_{03}-**There is no significant difference between aerobic exercise and aerobic exercise with resistance training on lipid profile in younger adults.

✓ 4.7.2 ALTERNATE HYPOTHESIS

- **H_{A1}-** There is significant effect of aerobic exercise on lipid profile in younger adults.
- **H_{A2}-** There is significant effect of eccentric resistance training with aerobic exercise on lipid profile in younger adults.
- **H_{A3}-** There is significant difference between aerobic exercise and aerobic exercise with eccentric resistance training on lipid profile in younger adults.

4.8. MEASUREMENT TOOLS

- Haematological investigation of lipid profile (Total cholesterol, HDL,LDL,VLDL,Triglycerides).

4.9. STUDY METHOD

30 subjects who satisfy the inclusion criteria are selected and arranged in 2 groups.They are experimental group (group A), Control group (group B). Experimental group are treated with aerobic exercise with eccentric resistance training

Control group are treated with aerobic exercise alone.

✓ 4.9.1. TECHNIQUE

➢ 4.9.1.1. AEROBIC EXERCISE

1. METHODS:

- **Warm up phase**
  - Breathing exercise (2 minutes).
  - Stretching for Pectoralis major, triceps, Hamstring, calf muscles, quadriceps. (active static stretching each muscle hold for 30 sec, 2 repetition).
  - Slow walking. (3 minutes).
- **Dynamic phase**
  - Exercise mode –walking.
  - Intensity- 60 to 80 % of Target Heart Rate.
  - **KARVONEN's FORMULA:**
    THR=(HRmaxHRrest)(0.40&0.85)}+ Hrrest.
  - Duration 10 MIN.
  - Frequency 5 Days /week.
- **Cool down phase**
  - Slow walking (5 minutes).
  - Breathing exercise (2 minutes).
  - Ankle toe movements(3 minutes).

2. PROGRESSION:

WEEK	WARM UP	DYNAMIC	COOL DOWN
0-2	10 min	10 min	10 min
2-4	10 min	20 min	10 min
4-6	10 min	30 min	10 min

➢ 4.9.1.2. ECCENTRIC RESISTANCE TRAINING

1. METHODS

The subjects 10 RM is calculated. Then according to Delorme method the resistance is given for the eccentric resistance training.

- Lowering the sand bag in a biceps curl.
- Lifting a weight with both legs and lowering it with one leg.

LOWERING THE SAND BAG IN A BICEPS CURL.

- Subject is made to sit comfortably.
- Weight is given in one hand.
- While doing flexion of the elbow, this hand is supported by the other hand. During extension of elbow, that support is removed.
- The same procedure is repeated for the other hand also.
- This is repeated for 5 times then it was progressed up to 10 times.

- **LIFTING A WEIGHT WITH BOTH LEGS AND LOWERING IT WITH ONE LEG**
  - Subject is made to sit in high sitting.
  - Weight is given to one leg.
  - While doing extension of the knee, the leg is supported by the other leg.
  - While doing flexion of the knee, the support is removed.
  - The same procedure is repeated for the other leg also.
  - This is repeated for 5 times then it is progressed up to 10 times.
- **DELORME METHOD**
  - 10 lifts with ½ 10 RM.
  - 10 lifts with ⅓10 RM.
  - 10 lifts with 10 RM.

4.10. PHOTOGRAPHIC ILLUSTRATION

- **ECCENTRIC RESISTANCE EXERCISE FOR BICEPS**

- **ECCENTRIC RESISTANCE EXRCISE FOR QUADRICEPS**

4.11. OUT COME MEASURES

- **BLOOD CHOLESTREOL LEVEL-HAEMATOLOGICAL INVESTIGATION**

  Total cholesterol, HDL, LDL, VLDL, Triglycerides.

4.12. STATISTICAL ANALYSIS

- Pre-test and Post-test values of the study will be collected and assessed for variation in improvement & their results will be analyzed using Independent `t' test and Paired `t' test.

INDEPENDENT `t' TEST (between groups)

$$t = \frac{\overline{X1} - \overline{X2}}{S} \sqrt{\frac{n_1 n_2}{(n_1 + n_2)}}$$

Where,

$$S = \sqrt{\frac{\sum d_1^2 + \sum d_2^2}{n_1 + n_{2-}2}}$$

PAIRED `t' TEST (within groups)

$$\mathbf{t} = \frac{\bar{d}\sqrt{n}}{S}$$

Where,

$$\mathbf{S} = \sqrt{\frac{\sum d^2 - \left[\bar{d}\right]^2 \times n}{n-1}}$$

S=combined standard deviation

d_1&d_2 =difference between initial & final readings in group A &group B respectively.

n_1&n_2=number of patients in group A & group B respectively.

$\overline{X_1}$&$\overline{X_2}$ =Mean of group A & group B respectively.

Level of significance: 5%.

DATA PRESENTATION

5. DATA PRESENTATION

5.1. TABULAR PRESENTATION

Paired ‘t’ Test

Table 5.1.1: Paired‘t’ test value for Total Cholesterol (mg/dl) among Experimental group.

Mean Mg/Dl	**Pre test**	**Post test**
	158.77	**153.33**
‘T’ Value	**4.300**	
P value& Level Of Significance	**P<0.05 & Significant**	

Table 5.1.2: Paired‘t’ test value for LDL in mg/dl among Experimental group.

Mean Mg/Dl	**Pre test**	**Post test**
	94.83	**85.27**
‘T’ Value	**4.846**	
P value& Level Of Significance	**p<0.05 & Significant**	

Table 5.1.3: Paired‘t’ test value for HDL in mg/dl among Experimental group.

Mean Mg/Dl	Pre test	Post test
	48.45	53.24
‘T’ Value	2.43	
P value& Level Of Significance	p<0.05 & Significant	

Table 5.1.4: Paired‘t’ test value for VLDL in mg/dl among Experimental group.

Mean Mg/Dl	Pre test	Post test
	16.28	14.42
‘T’ Value	1.02	
P value& Level Of Significance	p>0.05 & Not Significant	

Table 5.1.5: Paired‘t’ test value for Triglycerides in mg/dl among Experimental group.

Mean Mg/Dl	Pre test	Post test
	72.89	72.79
‘T’ Value	0.29	
P value& Level Of Significance	p>0.05 & Not Significant	

Table 5.1.6: Paired‘t’ test value for Total Cholesterol (mg/dl) among Control group.

Mean Mg/Dl	Pre test	Post test
	167.54	165.45
‘T’ Value	1.035	
P value& Level Of Significance	p>0.05 & Not Significant	

Table 5.1.7: Paired‘t’ test value for LDL in mg/dl among Control group.

Mean Mg/Dl	Pre test	Post test
	102.71	99.11
‘T’ Value	.597	
P value& Level Of Significance	p>0.05 & Not Significant	

Table 5.1.8: Paired‘t’ test value for HDL in mg/dl among Control group.

Mean Mg/Dl	Pre test	Post test
	31.19	32.64
‘T’ Value	1.964	
P value& Level Of Significance	p>0.05 & Not Significant	

Table 5.1.9: Paired‘t’ test value for VLDL in mg/dl among Control group.

Mean Mg/Dl	Pre test	Post test
	32.24	31.80
‘T’ Value	.908	
P value& Level Of Significance	p>0.05 & Not Significant	

Table 5.1.10: Paired‘t’ test value for Triglycerides in mg/dl among Control group.

Mean Mg/Dl	Pre test	Post test
	78.30	77.18
‘T’ Value	.894	
P value& Level Of Significance	p>Not significant	

Independent 'T' Test

5.1.11: Independent't' test value for Total Cholesterol (mg/dl) for Experimental group and Control group.

Test	Pre-Test		Post-Test	
Group	Experimental	Control	Experimental	Control
	158.83	158.0	153.35	167.54
'T' Value	.082		1.55	
P value & Level Of Significance	p>0.05 & Not Significant		p> 0.05 &Not Significant	

5.1.12: Independent't' test value for LDL in mg/dl for Experimental group and Control group.

Test	Pre-Test		Post-Test	
Group	Experimental	Control	Experimental	Control
	94.83	99.02	85.24	102.67
'T' Value	.417		2.797	
P value & Level Of Significance	p>0.05 & Not Significant		p<0.05 & Significant	

5.1.13: Independent't' test value for HDL in mg/dl for Experimental group and Control group.

Test	Pre-Test		Post-Test	
Group	Experimental	Control	Experimental	Control
	48.44	43.92	52.65	32.69
'T' Value	1.195		4.948	
P value & Level Of Significance	p>0.05 & Not Significant		p<0.05 & Significant	

5.1.14: Independent't' test value for VLDL in mg/dl for Experimental group and Control group.

Test	Pre-Test		Post-Test	
Group	Experimental	Control	Experimental	Control
	16.28	31.80	15.81	28.89
'T' Value	4.594		.500	
P value & Level Of Significance	p>0.05 & Significant		p<0.05 & Not Significant	

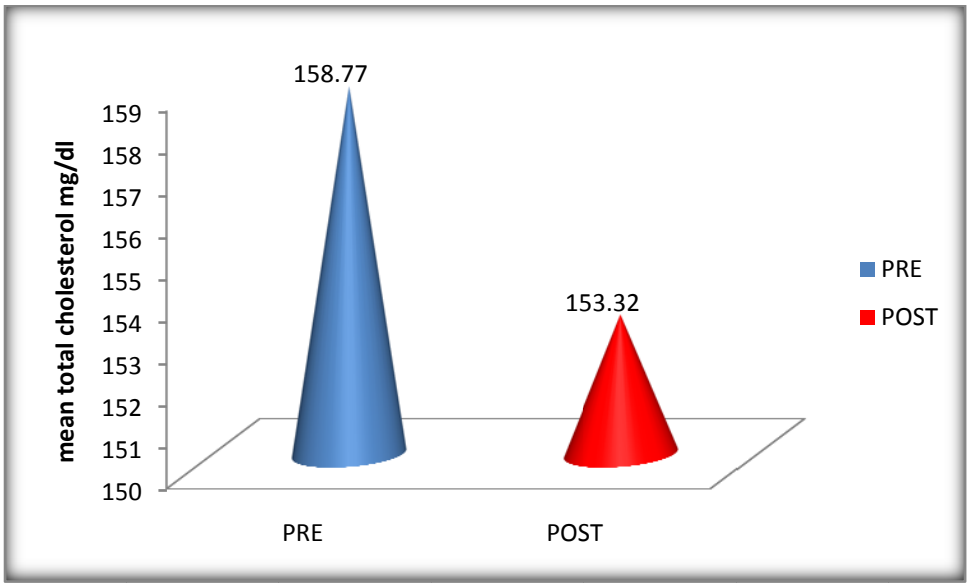
5.1.15: Independent‘t’ test value for Triglycerides in mg/dl for Experimental group and Control group.

Test	Pre-Test		Post-Test	
Group	Experimental	Control	Experimental	Control
	75.046	78.22	75.82	74.65
‘T’ Value	.652		.186	
P value & Level Of Significance	p>0.05 & Not Significant		p>0.05 & Not Significant	

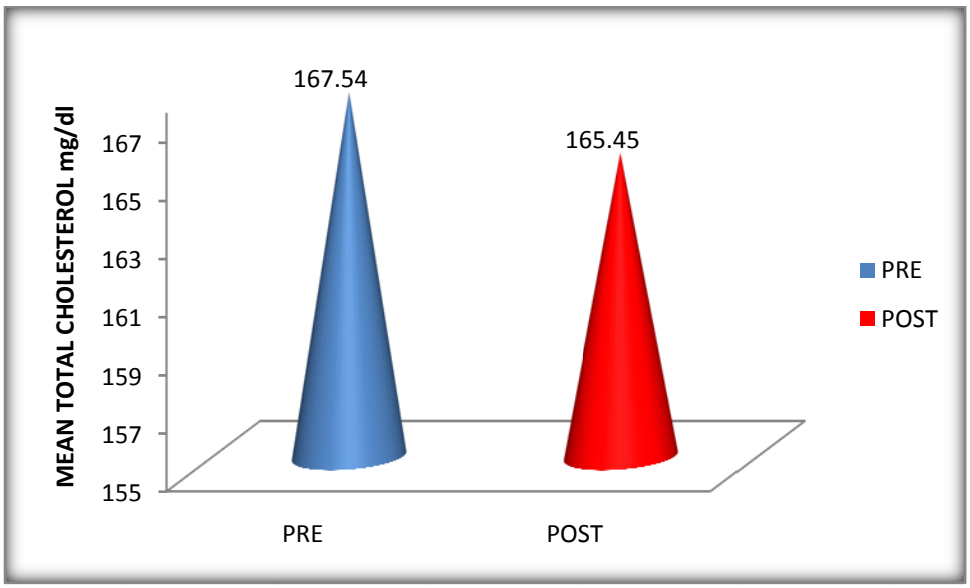
5.2. GRAPHICAL PRESENTATION

Paired ‘t’ test

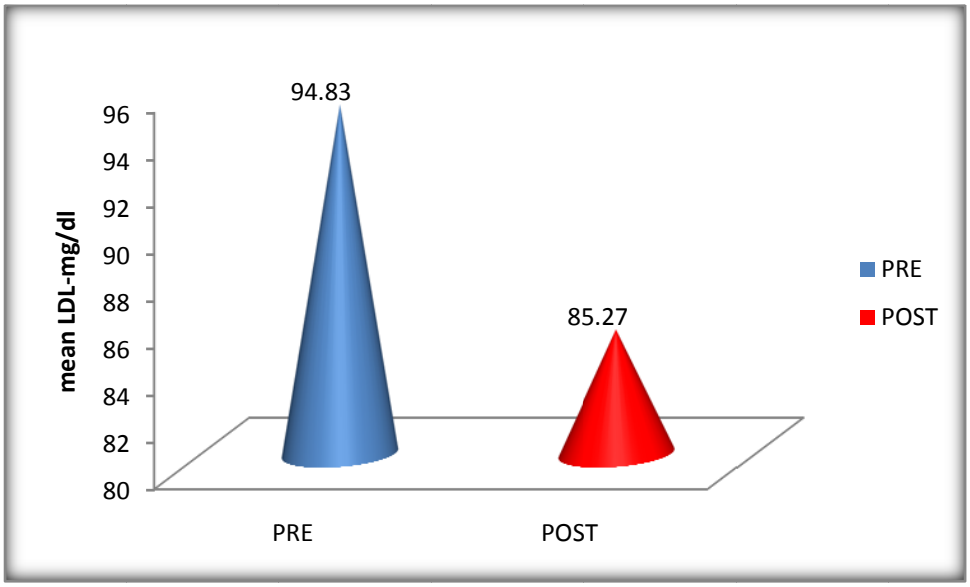
Graph 5.2.1: Total cholesterol - pre and post test mean for Experimental group.



Graph 5.2.2: Total cholesterol - pre and post test mean for Control group.

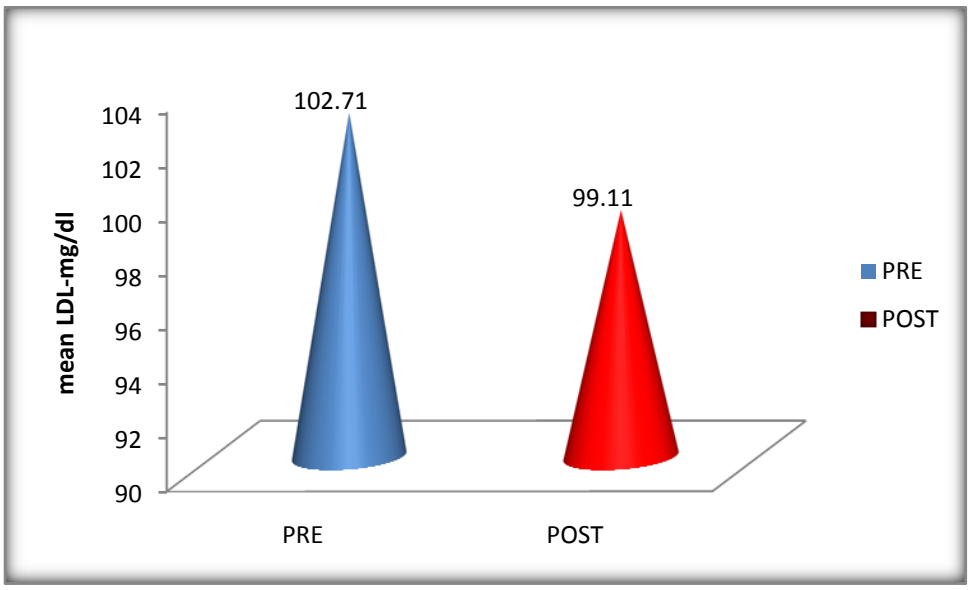


Graph 5.2.3:. LDL-pre and post test mean for Experimental group.

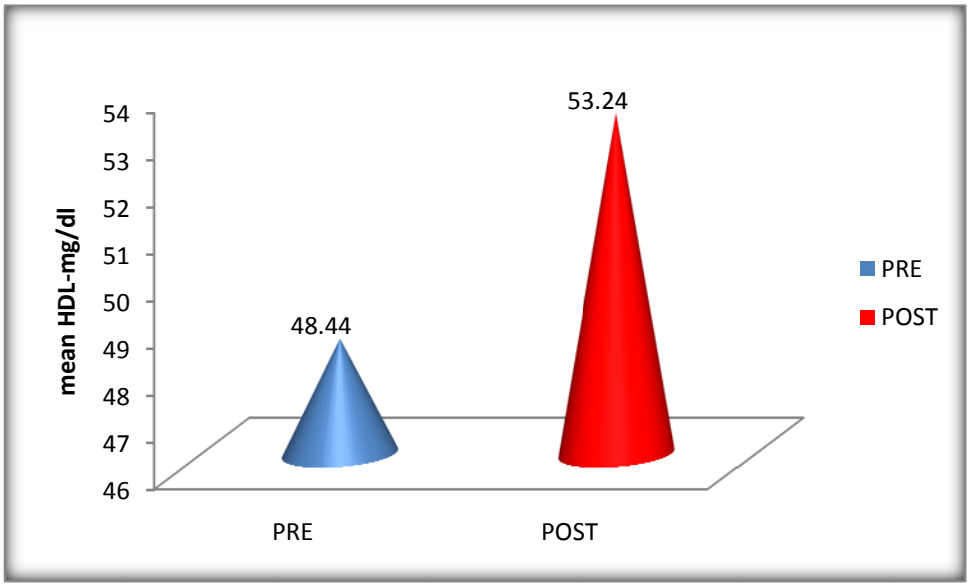


Graph 5.2.4: LDL-pre and post test mean for Control group.

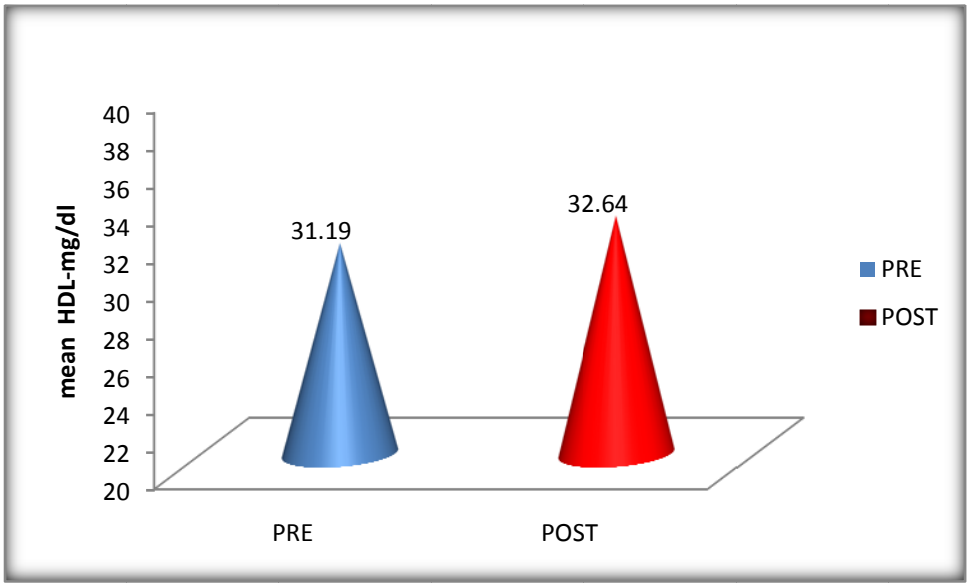
Graph 5.2.5: HDL-pre and post test mean for



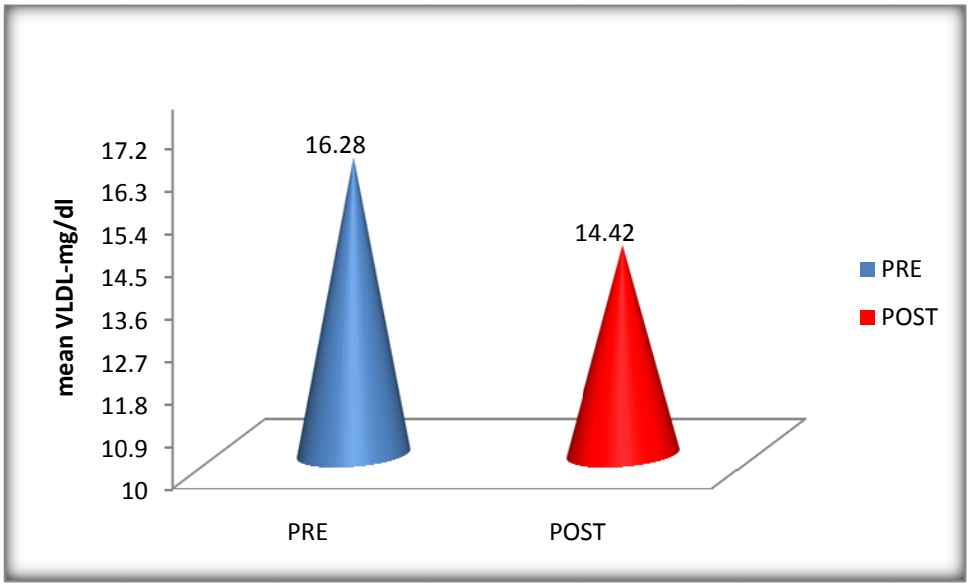
Experimental group.



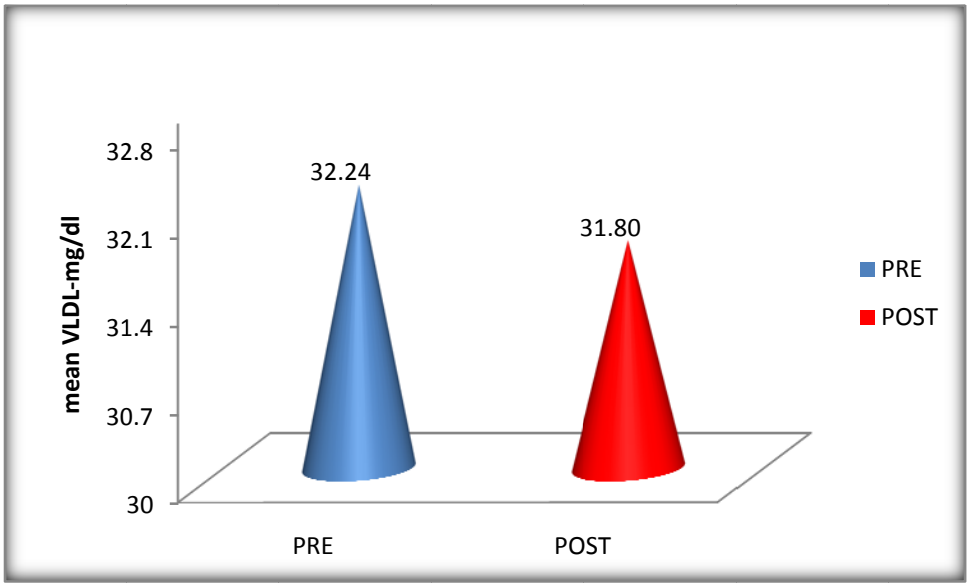
Graph 5.2.6: HDL-pre and post test mean for Control group.



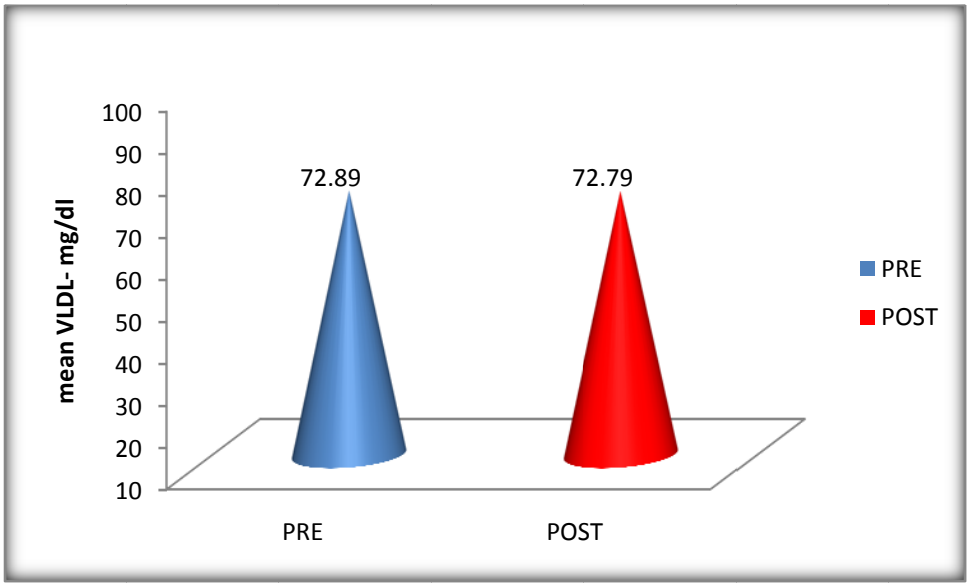
Graph 5.2.7: VLDL-pre and post test mean for Experimental group.



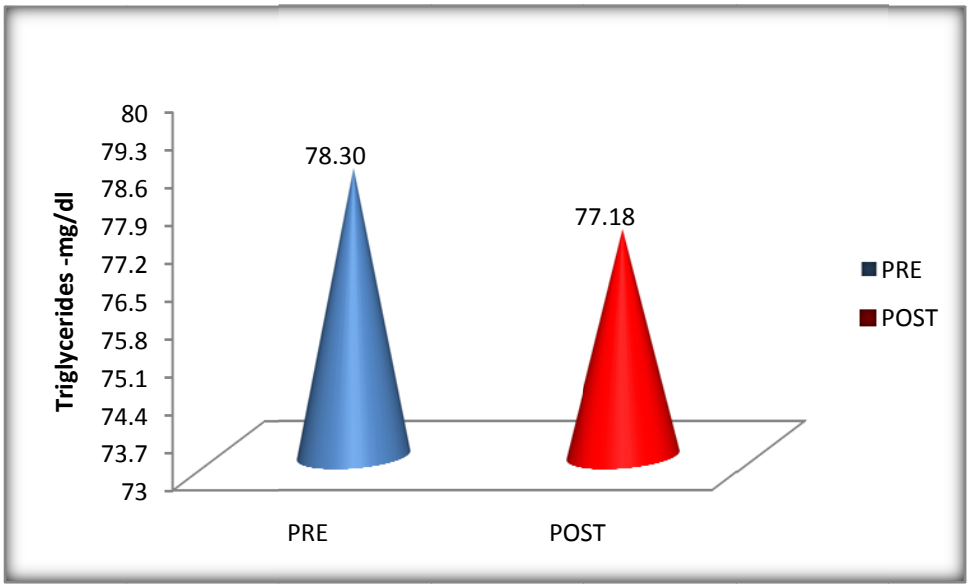
Graph 5.2.8: VLDL-pre and post test mean for Control group.



Graph 5.2.9: Triglycerides–pre and post test mean for Experimental group.

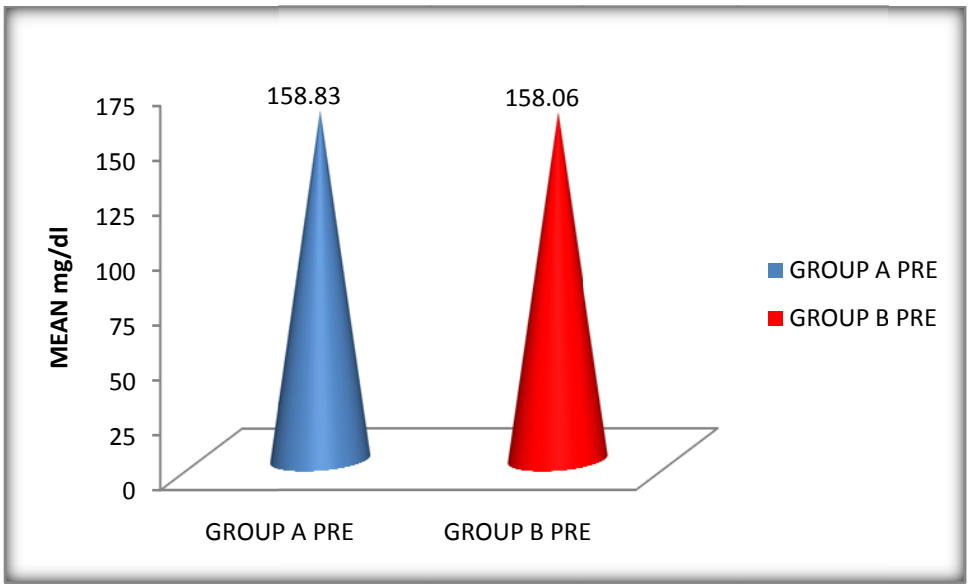


Graph 5.2.10: Triglycerides –pre and post test mean for Control group

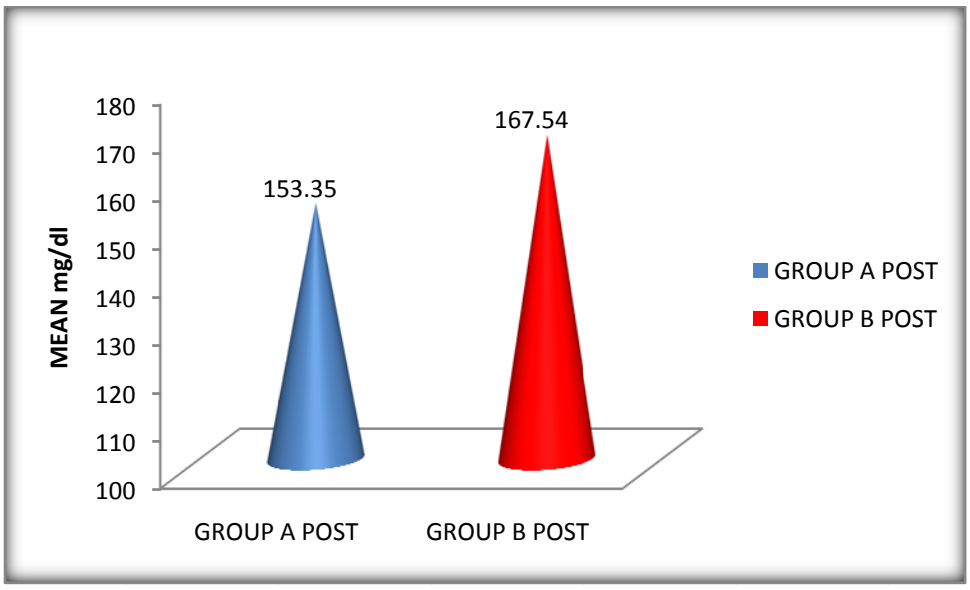


Independent ‘t’ test

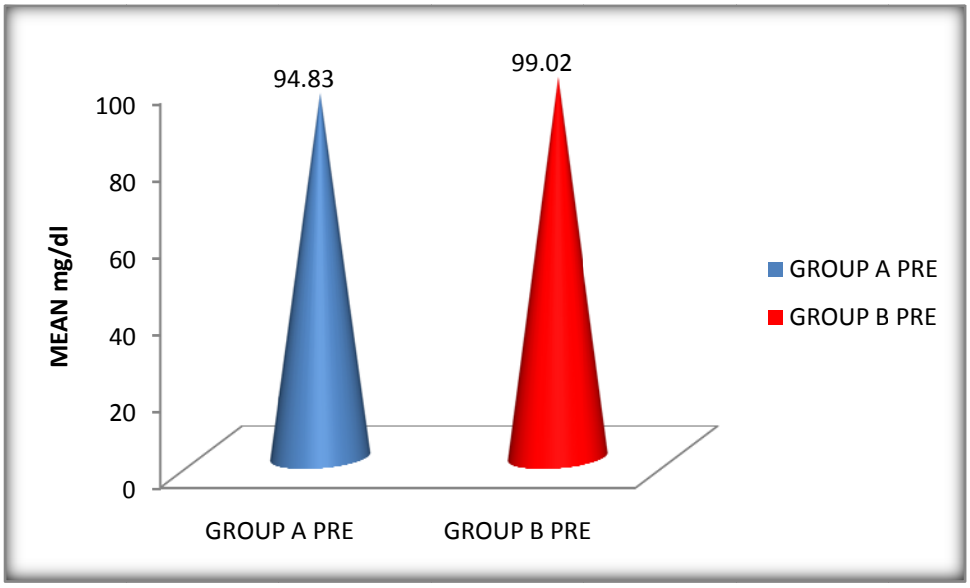
Graph 5.3.1. Total cholesterol – Pre test mean values for Experimental and Control group.



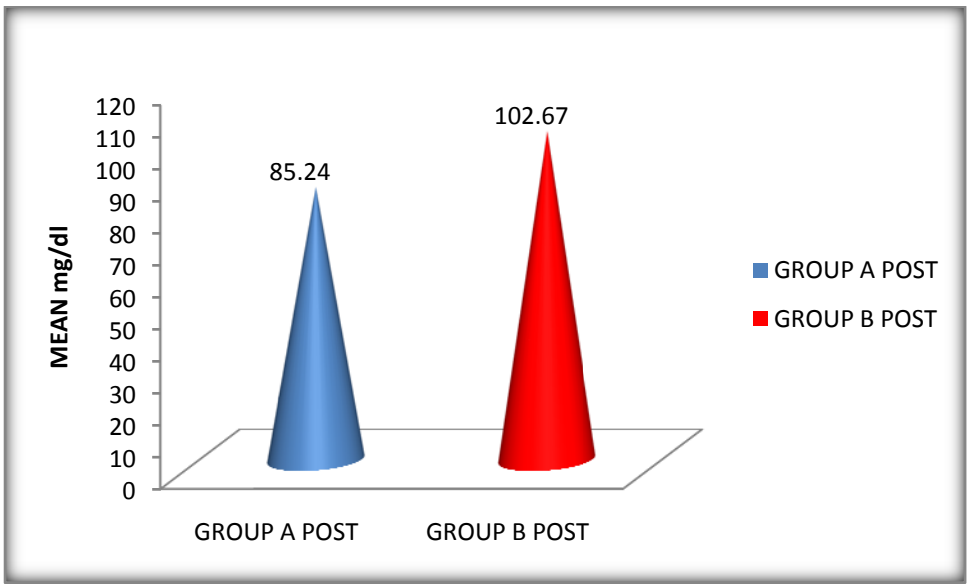
Graph 5.3.2: Total cholesterol – post test mean values for Experimental and Control group.



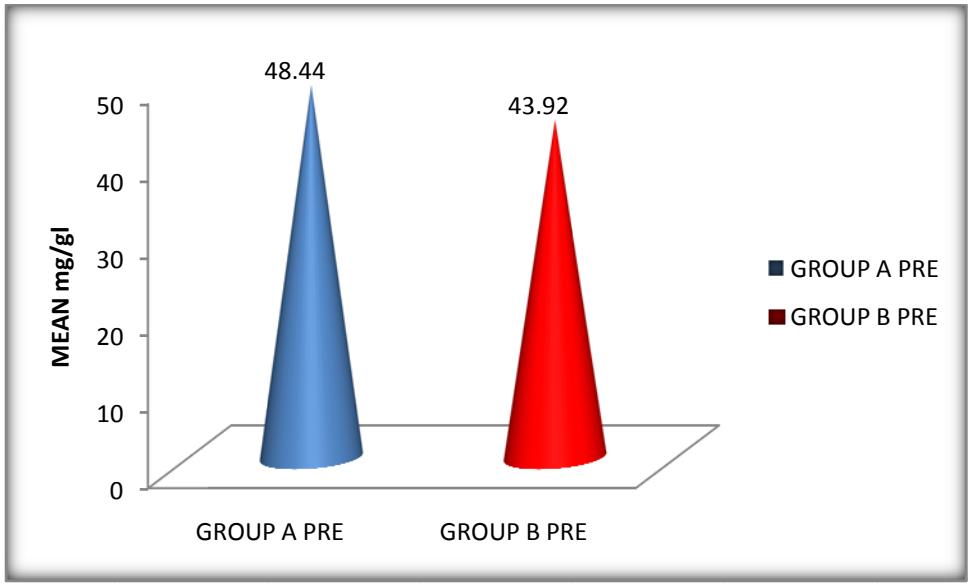
Graph 5.3.3: LDL – Pre test mean values for Experimental and Control group.



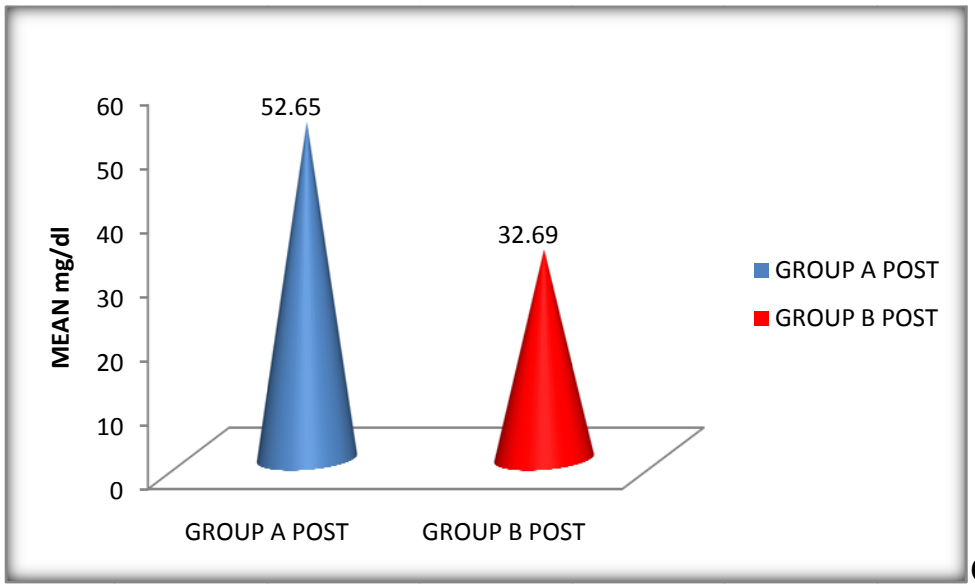
Graph 5.3.4: LDL – Post test mean values for Experimental and Control group.



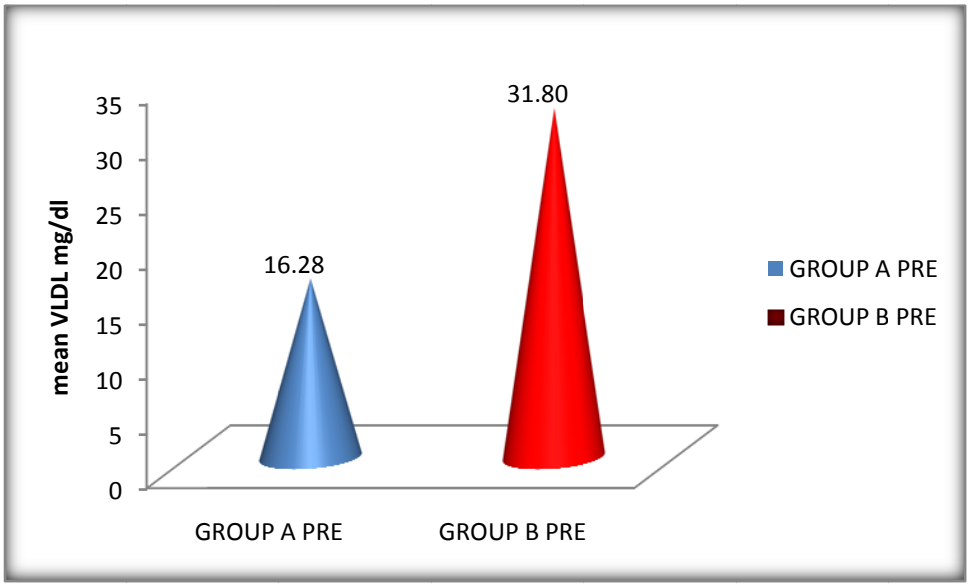
Graph 5.3.5: HDL Pre test mean values for Experimental and Control group.



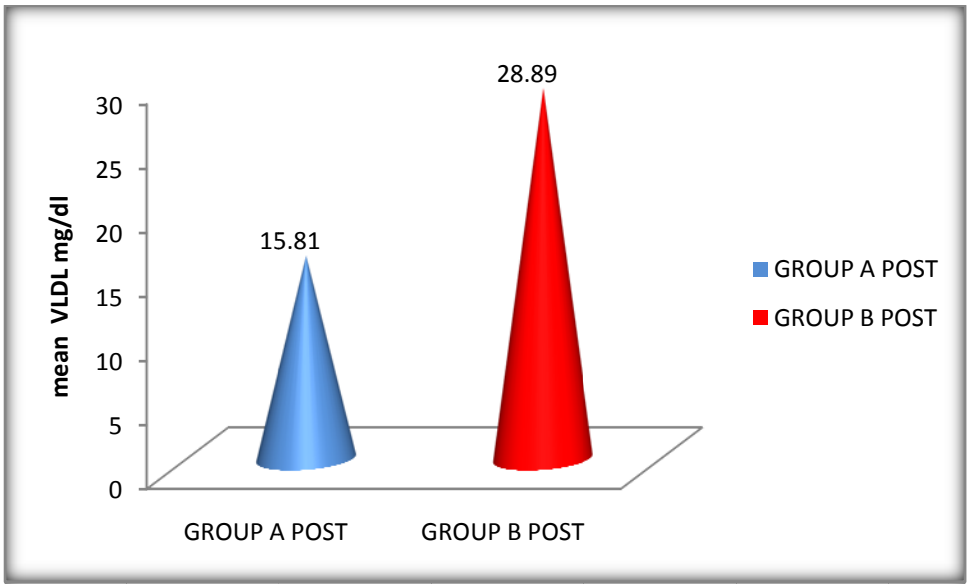
Graph 5.3.6: HDL Post test mean values for Experimental and Control group.



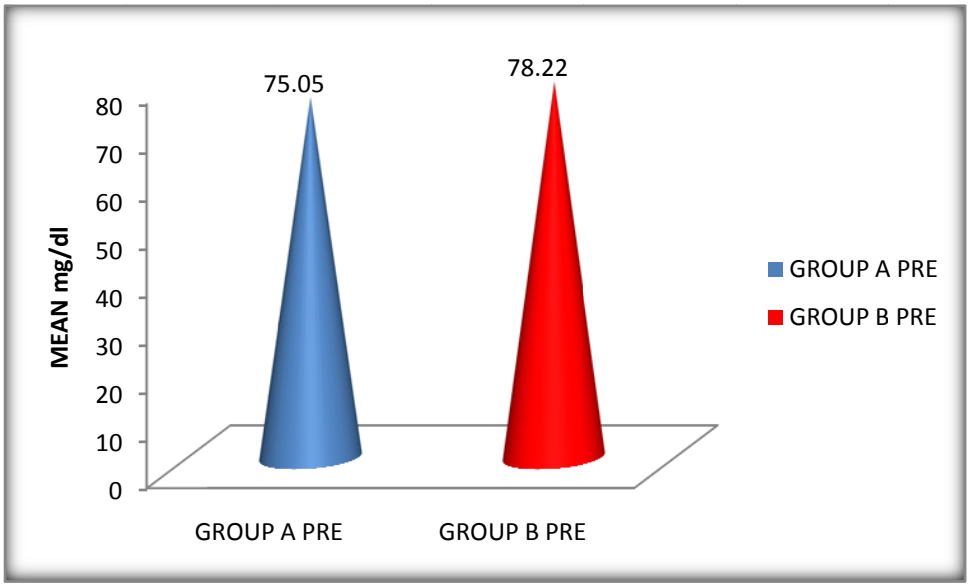
Graph 5.3.7: VLDL Pre test mean values for Experimental and Control group.



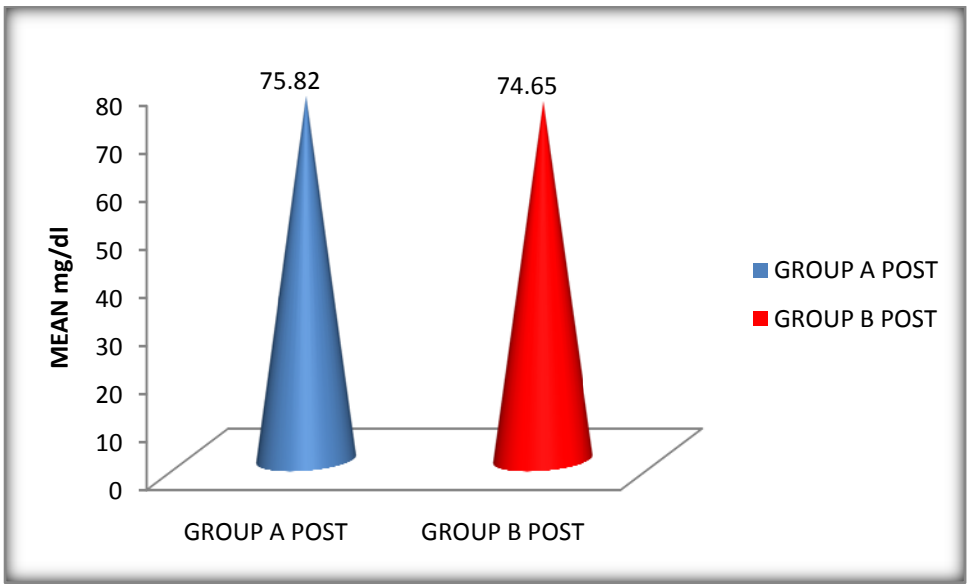
Graph 5.3.8: VLDL Post test mean values for Experimental and Control group.



Graph 5.3.9: Triglyceride- Pre test mean values for Experimental and Control group.



Graph 5.3.10: Triglyceride- Post test mean values for Experimental and Control group.



DATA ANALYSIS & RESULTS

6. DATA ANALYSIS AND RESULTS

6.1. TOTAL CHOLESTEROL

Paired t test values of total cholesterol for Experimental group:

When the pre-test and the post test values of the group A were analysed by paired‘t’ test, the value was 4.30. The table value of ‘t’ at 5% level of significance for 14 degrees of freedom is 2.145, which was lesser than the calculated value. Hence null hypothesis was rejected.

Paired t test values of total cholesterol for Control group:

When the pre-test and the post test values of the group B were analysed by paired ‘t’ test, the value was 1.035. The table value of‘t’ at 5% level of significance for 14 degrees of freedom is 2.145, which was greater than the calculated value. Hence null hypothesis was accepted.

Independent ‘t’ test values of pre test total cholesterol for Experimental and Control group:

When the pre-test values of the group A and group B were analysed by independent ‘t’ test, the value was .082.The table value of ‘t’ at 5% level of significance for 28 degree of freedom is 2.048,which was greater than the calculated value. Hence it was proved that there was no significant difference between the groups and thus homogeneity was maintained before the experiment.

Independent ‘t’ test values of post test total cholesterol for Experimental and Control group:

When the post- test values of the group A and group B were analysed by independent‘t’ test, the value was 1.55.The table value of ‘t’ at 5% level of significance for 28 degree of freedom is 2.048,which was greater than the calculated value. Hence it was proved that there was no significant difference between the groups and thus null hypothesis was accepted.

6.2. LDL

Paired t test values of LDL for Experimental group:

When the pre-test and the post test values of the group A were analysed by paired‘t’ test, the value was 4.85. The table value of‘t’ at 5% level of significance for 14 degrees of freedom is 2.145, which was lesser than the calculated value. Hence null hypothesis was rejected.

Paired t test values of LDL for Control group:

When the pre-test and the post test values of the group B were analysed by paired‘t’ test, the value was .597. The table value of‘t’ at 5% level of significance for 14 degrees of freedom is 2.145, which was greater than the calculated value. Hence null hypothesis was accepted.

Independent ‘t’ test values of pre test LDL for Experimental and Control group:

When the pre- test values of the group A and group B were analysed by independent‘t’ test, the value was .417.The table value of ‘t’ at 5% level of significance for 28 degree of freedom is 2.048,which was greater than the calculated value. Hence it was proved that there was no significant difference between the groups and thus homogeneity was maintained before the experiment.

Independent ‘t’ test values of post test LDL for Experimental and Control group:

When the post- test values of the group A and group B were analysed by independent ‘t’ test, the value was 2.797.The table value of ‘t’ at 5% level of significance for 28 degree of feedom is 2.048,which was lesser than the calculated value. Hence it was proved that there was significant difference between the groups and thus null hypothesis rejected.

6.3.HDL

Paired t test values of HDL for Experimental group:

When the pre-test and the post test values of the group A were analysed by paired‘t’ test, the value was 2.43. The table value of‘t’ at 5% level of significance for 14 degrees of freedom is 2.145, which was lesser than the calculated value. Hence null hypothesis was rejected.

Paired t test values of HDL for Control group:

When the pre-test and the post test values of the group B were analysed by paired‘t’ test, the value was 1.964. The table value of‘t’ at 5% level of significance for 14 degrees of freedom is 2.145, which was greater than the calculated value. Hence null hypothesis was accepted.

Independent ‘t’ test values of pre test HDL for Experimental and Control group:

When the pre- test values of the group A and group B were analysed by independent ‘t’ test, the value was 1.195.The table value of ‘t’ at 5% level of significance for 28 degree of freedom is 2.048,which was greater than the calculated value. Hence it was proved that there was no significant difference between the groups and thus homogeneity was maintained before the experiment.

Independent ‘t’ test values of post test HDL for Experimental and Control group:

When the post- test values of the group A and group B were analysed by independent ‘t’ test, the value was 4.95.The table value of ‘t’ at 5% level of significance for 28 degree of freedom is 2.048,which was lesser than the calculated value. Hence it was proved that there was significant difference between the groups and thus null hypothesis rejected.

6.4. VLDL

Paired t test values of VLDL for Experimental group:

When the pre-test and the post test values of the group A were analysed by paired‘t’ test, the value was 1.02. The table value of‘t’ at 5% level of significance for 14 degrees of freedom is 2.145, which was greater than the calculated value. Hence null hypothesis was accepted.

Paired t test values of VLDL for Control group:

When the pre-test and the post test values of the group B were analysed by paired‘t’ test, the value was .908. The table value of‘t’ at 5% level of significance for 14 degrees of freedom is 2.145, which was greater than the calculated value. Hence null hypothesis was accepted.

Independent ‘t’ test values of pre test VLDL for Experimental and Control group:

When the pre- test values of the group A and group B were analysed by independent‘t’ test, the value was 4.59.The table value of ‘t’ at 5% level of significance for 28 degree of freedom is 2.048,which was lesser than the calculated value. Hence it was proved that there was significant difference between the groups.

Independent ‘t’ test values of post test VLDL for Experimental and Control group:

When the post- test values of the group A and group B were analysed by independent ‘t’ test, the value was .500.The table value of ‘t’ at 5% level of significance for 28 degree of freedom is 2.048,which was greater than the calculated value. Hence it was proved that there was no significant difference between the groups and thus null hypothesis was accepted.

6.5. Triglycerides

Paired t test values of Triglycerides for Experimental group:

When the pre-test and the post test values of the group A were analysed by paired‘t’ test, the value was 0.29. The table value of‘t’ at 5% level of significance for 14 degrees of freedom is 2.145, which was greater than the calculated value. Hence null hypothesis was accepted.

Paired t test values of Triglycerides for Control group:

When the pre-test and the post test values of the group B were analysed by paired‘t’ test, the value was .894. The table value of‘t’ at 5% level of significance for 14 degrees of freedom is 2.145, which was greater than the calculated value. Hence null hypothesis was accepted.

Independent ‘t’ test values of pre test Triglycerides for Experimental and Control group:

When the pre- test values of the group A and group B were analysed by independent‘t’ test, the value was .652.The table value of ‘t’ at 5% level of significance for 28 degree of freedom is 2.048,which was greater than the calculated value. Hence it was proved that there was no significant difference between the groups and thus homogeneity was maintained before the experiment.

Independent ‘t’ test values of post test Triglycerides for Experimental and Control group:

When the post- test values of the group A and group B were analysed by independent‘t’ test, the value was .186.The table value of ‘t’ at 5% level of significance for 28 degree of freedom is 2.048,which was greater than the calculated value. Hence it was proved that there was no significant difference between the groups and null hypothesis accepted.

DISCUSSION

7. DISCUSSION

Hyperlipidaemia is now talking its place as one of the main threats to human health in 21st

Century. Aerobic exercise is normally recommended for reducing lipid level in the blood, but eccentric resistance training with aerobic exercise for lowering lipid levels in the blood is still lacking in clinical in clinical practise.

This study was conducted with 30 subjects who fulfilled the inclusion and exclusion criteria were selected through purposive sampling technique and were assigned into two groups. Group A and Group B. The group A consist of 15 subjects performed eccentric resistance training with aerobic exercise and the groupB performed aerobic exercise only. Lipid profile was measured by haematological investigation. The scores were taken before and after 6 weeks of training.

The statistical analysis was done using paired 't' test between pre test and post test values of both the groups. At 5% level of significance the result showed improvement in Total cholesterol, HDL, LDL in group A. There is no significant improvement in group B. Independent 't' test between post values showed significant improvement in HDL, LDL level in the blood.

There was a significant reduction in total cholesterol level , increase in HDL level and reduction in LDL level in group A. But in group B there is no significant improvement in any of the out comes.

The exercise significantly reduce triglycerides and stimulate several metabolic enzyme systems in the muscles and liver to convert some of the cholesterol especially LDL to a more favorable form, such as HDL-cholesterol. The primary reason for elevation in HDL is an increase in lipoprotein lipase activity in response to exrcise. Lipoprotein lipase accelerates the breakdown of the triglycerides, resulting in a transfer of cholesterol and other substances to HDL.

In aerobic training, walking is one of the easiest physical activities. It an ideal exercise no matter with the age. It is safe and inexpensive and requires less strength than the resistance training.

The mechanism associated with improved lipid level in eccentric resistance training with aerobic exercise include biomechanical and structural adaptations of the skeletal muscles and systemic influences on physical activity.

Biochemical adaptations include a upregulation of mitochondrial proteins involved in respiration, increased glycogen synthesis activity, and increased in GLUT4 protein content

Facilitated fatty acid mobilization from adipose tissue through increased rate of lipolysis, Improved transport of free fatty acid through the muscle fibres plasma membrane.

Structural adaptations include increase in contractile protein content, increased size and number of mitochondria, increased quantity of enzymes involved in β oxidation, citric acid cycle metabolism, and the electron transport chain with in specifically trained muscle fiber and maintenance of cellular integrity and function resulting in the higher basic metabolic rate, potentially greater glucose up take

Visceral and intra muscular fat stores is directly proportional to insulin sensitivity via fat specific cytokine mediated path way

There is no significant improvement in the group B ,VLDL and Triglycerides in Group A, because of the lesser duration of the study and dietary factors .

So in future, studies have to be conducted for longer duration to find the influence of eccentric resistance training on VLDL, Triglycerides and Total lipid levels in the blood and with proper diet restrictions .

SUMMARY & CONCLUSION

8. SUMMARY AND CONCLUSION

Improving the blood cholesterol level in the blood is the primary goal in the study. This study was carried out to find out the effect of eccentric exercise training with aerobic exercise on blood lipid level in younger adults. It has been conducted with two groups, consisting of 30 subjects. Group A received aerobic exercise with eccentric resistance training and group B received aerobic exercise alone. Lipid level in the blood was measured using haematological investigation. Pre-test was taken before starting exercise. Post test was taken after completion of 6 weeks of training. The statistical analysis was done using paired 't' test between pre test and post test values of both the groups. At 5% level of significance the result showed improvement in Total cholesterol, HDL, LDL in group A. There is no significant improvement in group B. Independent 't' test between post values showed significant improvement in HDL, LDL level in the blood

Based on these result it can be concluded that eccentric resistance training can be added to aerobic exercise to improve the cholesterol level in the blood in younger adults

LIMITATIONS & SUGGESTIONS

9. LIMITATION AND SUGGESTION

- ✓ This study was conducted in small size. It can be conducted with large sample size in the future.
- ✓ This study included only the people with total cholesterol below 250 mg/dl. It can be carried out among participants who fall into either extremes of the range.
- ✓ This study include only the males with age ranges from 20 to 30.It can be conducted among participant other than this age ranges and in females also
- ✓ In this study the treatment was given for 6 weeks only .It can be prolonged up to 6 months.
- ✓ In this study the eccentric exercise was given to quadriceps and biceps. For future it can be given for other major muscle group of upper limb and lower limb
- ✓ In this study the homogeneity was not maintained for outcome measure VLDL before the experiment. It has to be maintained in future studies.
- ✓ No diet restrictions .It has to be maintained in the future studies with proper diet charts
- ✓ Outcome measures for this study was Total cholesterol, HDL, LDL, VLDL and Triglycerides. TC/HDL and LDL/HDL ratio will be added for future studies.

BIBLIOGRAPHY

BIBILIOGRAPHY

1. Alexandria va, New Research shows That Combining Aerobic Exercise With High Force Eccentric resistance training Improves Glucose Control in Diabetes Patients. The American Physical therapy Association, 703-706-3397,2008.
2. Adira Giacca, Yolanda Groenewond , Elaine Tsui, Patricia and Bernard Zinman, diabetes, vol.47, November 1998, Pg .no.1763-1770.
3. American scientist Vol. 65, No.2 March April 1977,pp.177-187
4. American College of Sports Medicine: ACSM's Guidelines for Exercise Testing and Prescription 7th edition. Philadelphia: Lippincott Williams & Wilkins**;** 2006
5. Anderson , J.L., Andersen, L.L.,& Dela, F. Resistance training and insulin action in humans: effects of de-training. Journal of Physiology. 2003;551:1049-1058.
6. Baraz, Fahey, Landry, White, 1994, Clinical Diabetes
7. Balter 1988.GT., Stokroos RJ text issue .Science adb movement
8. Black MA, Green DJ, Cable NT: Exercise prevents age-related decline in nitric-oxide - mediated vasodilator function in cutaneous microvessels. J Physiol 2008, 586:3511-3524.
9. Boreham CAG, Kennedy RA, Murphy MH, Tully M, Wallace WFM, Young I: Training effects of short bouts of stair climbing on cardiorespiratory fitness, blood lipids, and homocysteine in sedentary young women. Br J Sports Med 2005, 39:590-593.
10. Castaneda C, Layne JE, Munoz-Orians L, et al. A randomized control trail of resistance exercise training to improve glycemic control in older adults with Type 2 diabetes. Diabetes Care. 2002;25:2335-2341
11. Cornelissen VA, Fagard RH: Effect of resistance training on resting blood pressure: a meta-analysis of randomized controlled trials. J Hypertens 2005, 23:251-259.
12. Carol Birch, Diabetes and walking as your physical activity ,February15,2004
13. Cox KL, Burke V, Beilin LJ, Puddey IB: A comparison of the effects of swimming and walking on body weight, fat distribution, lipids, glucose, and insulin in older women - the Sedentary Women Exercise Adherence Trial 2. Metabolism 2010 [http://www.ncbi.nlm.nih.gov/pubmed/20197194].

14. Cox KL, Burke V, Morton AR, Gillam HF, Beilin LJ, Puddey IB: Long-term effects of exercise on blood pressure and lipids in healthy women aged 40-65 years: the Sedentary Women Exercise Adherence Trial (SWEAT). J Hypertens 2001, 19:1733-1743

15. Davidson's principles and practise of Medicine 19th edition

16. Darcy. J. Cuff, MSC Graydons. S. Meneilly, MD, Effective exercise modality to reduce Insulin resistance in women With Type 2 Diabetes, Diabetes Care 26:2977-2982,2003.

17. David K Mcculloch, Effects of exercise in diabetes mellitus 2008.

18. Davidson et al, Effects of exercise Modality on insulin Resistance and Functional Limitation in Older Adults. Archives of Internal medicine, 2009;169(2):12

19. Del Aguila LF, Krishnan RK, Ulbrecht JS, et al. Muscle damage impairs insulin stimulation of IRS- 1, PI 3 – kinase, and Akt- kinase in human skeletal muscle. Am j Pohysiol Endocrinol Metab. 2000;279

20. Drexel, H., Saely, C.H. Metabolic and anti- inflammatory benefits of eccentric endurance exercise-a pilot study. European Journal of Clinical Investigation.38(4):218-226

21. Dunstan DW, Mori TA, Puddey IB, BeilinLJ, Burke V, Morto n AR, Stanton KG: the independent and combined effects of aerobic exercise and dietary fish intake on serum lipids and glycemic control in NIDDM: a randomized control study. Diabetes Care 20:913-921,1997

22. EA Gulve.Phd (2008) PhD, Exercise and Glycemic control in Diabetes Vol.88. No.11,November 2008.

23. Eur Heart J. 2003 Jan 24(11)987-1003

24. Elliott KJ, Sale C, Cable NT: Effects of resistance training and detraining on muscle strength and blood lipid profiles in postmenopausal women. Br J Sports Med 2002, 36:340-345.

25. Garelnabi M, Veledar E, Abramson J, et al.: Physical Inactivity and Cardiovascular Risk: Baseline Observations from Men and Premenopausal Women. J Clin Lab Anal 2010, 24:100-105

26. GeraldF.Fletcher, MD, Circulation.1995;91:580

27. Gordom DJ, Probstfield JL, Garrison RJ, Neaton JD, Castelli WP, Knoke JD, Jacobs DR Jr, Bangdiwala S, Tyroler HA: High density lipoprotein cholesterol and cardiovascular disease: Four prospective American studies. Circulation 1989, 79:8-15.

28. Hedden, enhanced physical Readiness program, 1988:14;178

29. Halbest JA, Silagyc, Hurley BF, Roth, .Resistance training

30. Hill et al .Fedak . Journal of experimental Biology 204,3877-3885

31. Isabel C.D. Ribeiro; Rodrigo T, HDL Atheroprotection by Aerobic Exercise Training Science in sports and Exercise.2008;40(5):779-786

32. Jason J. Winnik , Winnick Journal of clinical endocrinology and Metabolism,.2007, 1524

33. J.P. Kirwan and L.F. del Aguila, Insulin signalling, exercise and cellular integrity,2003,31, 1281-1285.

34. Jeffrey Janot, M.S. and Len Kravitz, Ph.D., Training Clients with Diabetes,2009.

35. Kelley GA, Kelley KA, Tran ZV: Aerobic exercise and resting blood pressure: a meta-analytic review of randomized, controlled trials. Prev Cardiol 2001, 4:73-80.

36. Kelley GA, Kelley KS, Tran ZV: Walking lipids and lipoproteins: meta-analysis of randomized controlled trials. Prev Med 2004, 38:651-661.

37. Kelley GA, Kelley KS: Aerobic exercise and lipids and lipoproteins in men: a meta-analysis of randomized controlled trials. J Men's Health Gend 2006, 3:61-7

38. Kelley GA, Kelley KS: Progressive resistance exercise and resting blood pressure: a meta-analysis of randomized controlled trials. Hypertension 2000, 35:838-843.

39. Kim ES, Im JA, Kim KC, Park JH, Suh SH, Kang ES, Kim SH, Jekal Y, Lee CW, Yoon YJ, Lee HC, Jeon JY: Improved insulin sensitivity and adiponectin level after exercise training in obese Korean youth. Obesity 2007, 15:3023-3030.

40. Kirwan JP, Hickner RC, Yarasheski KE, et al. Eccentric exercise induces insulin resistance in healthy individuals. J Appl Physiology. 1992;72:2197-2202

41. Kohrt WM, Obert KA, Holloszy JO: Exercise training improves fat distribution patterns in 60- to 70-year old men and women. J Gerontol 1992, 47:M99-M105

42. Kriska, sports medicine, Volume 29, No. 31st March 2000, Pg :147-151

43. Laaksonen DE, Atalay M, Niskanen LK, Mustonen J, Sen CK, Lakka TA,Uusitupa MI: Aerobic exercise and the lipid profile in type 1 diabetic men: a randomized controlled trial. Med Sci Sports Exerc 2000,32:1541-1548.

44. LaStayo PC, Ewy GA, Pierotti DD, et al. The positive effects of negative work:increase muscle strength and decrease fall risk in a fairly elderly population. J Gerontol A Biol Sci Med Sci.2003;58;M 419-M424.

45. Leon AS, Sanchez OA: Response of blood lipids to exercise training alone or combined with dietary intervention. Med Sci Sports Exerc 2001, 33:S502-S515. discussion S528-S529

46. Lindstrom, Ericksson, T.T. Valle, Laakso, Rastar N. Engl j. Mad. 2001, May 3; 344(18);1343-501133990

47. Lipid metabolism and Genetic disease, 1953-1947

48. Marcell TJ, McAuley KA, Traustadottir T, Reaven PD: Exercise training is not associated with improved levels of Creactive protein or adiponectin. Metabolism 2005, 54:533-541

49. Marques E, Carvalho J, Soares JMC, Marques F, Mota J: Effects of resistance and multicomponent exercise on lipid profiles of older women. Maturitas 2009, 63:84-88.

50. Martins RA, Neves AP, Coelho-Silva MJ, Veríssimo MT, Teixeira AM: Highsensitivity C-reactive protein, body fat and physical exercise in older people. Eur J Appl Physiol 2010 [http://www.ncbi.nlm.nih.gov/pubmed/20437055].

51. Matthew D. Horden , PhD, Diabetes patients should have regular exercise, Weight training ScienceDaily June 15,2009.

52. Matthews CE, Freedson PS, Hebert JR, Stanek EJ III, Merriam PA, Rosal MC, Ebbeling CB, Ockene IS: Seasonal variation in household, occupational, and leisure time physical activity: longitudinal analyses from the seasonal variation of blood cholesterol study. Am J Epidemiol 2001, 153:172-183.

53. National Cholesterol Education Program: Third Report of the NationalCholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation,and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III)Volume 02. Washington, DC: NIH Publication; 2002:5215.

54. Ockene IS, Chiriboga DE, Stanek EJ III, Harmatz MG, Nicolosi R, Saperia G,Well AD, Freedson P, Merriam PA, Reed G, Ma Y, Matthews CE, Hebert JR:Seasonal variation in serum cholesterol levels: treatment implicationsand possible mechanisms. Arch Intern Med 2004, 164:863-870.

55. Peter W.F. Willson, Loren A.Zech, Clinica Acta Volume 151 issue 15 October 1985

56. Poehlman ET, Dvorak RV, Denino WF, Brochu M, Ades PA: Effects of resistance training and endurance training on insulin sensitivity in nonobese, young women: a controlled randomized trial. J Clin Endocrinol Metab 2000, 85:2463-2568.

57. Prep manual 3rd edition.

58. Rikli RE, Jones CJ: Development and validation of a functional fitness test for community-residing older adults. J Aging Phys Activ 1999,7:129-161.

59. Rita patutana Diabetes Mellitus, Type 2-A Review, medicine Aug 6, 2008

60. Robin L Marcus, PT, PhD, Research shows aerobic exercise combined with resistance training improves glucose control in Diabetes, October 31, 2008-15 :10.

61. Ryan AS, Nicklas BJ: Age-related changes in fat deposition in mid thigh muscle in women: relationships with metabolic cardiovascular disease risk factors. Int J Obes Relat Metab Disord 1999, 23:126-132.

62. S.L. Lindstedt, P.C. LaStayo and T.E. Reich, When Active Muscle Lengthen: Properties and Consequences of eccentric Contractions, New Physiol Sci 16: 256-261, 2001,

63. Soukup, j.etal.1994. " Resistance training Guidelines For Individuals with Diabetes mellitus.' The Diabetic Educator 20:129-3

64. Short KR, Vittone JL, Bigelow ML, Proctor DN, Rizza RA, Coenen-Schimke JM, Nair KS: Impact of aerobic training on age-related changes in insulin sensitivity and muscle oxidative capacity. Diabetes 2003,52:1888-1896.

65. Sillanpaa E, Hakkinen A, Punnonen K, Häkkinen K, Laaksonen DE: Effects of strength and endurance training on metabolic risk factors in healthy 40-65-year-old men. Scand J Med Sci Sports 2009, 19:885-895.

66. Stanley P Brown, Wayne C Miller, Exercise Physiology Basics 2009

67. Thomas D.E, Elliott .E.J; Naughton . G.A, University of Sidney, Australia(1995)

68. Thomas H. Marwick, MD, PhD, Chair; Matthew D. Hordern, PhD; Exercise training for Type 2 Diabetes Mellitus

69. Thune I, Njolstad I, Lochen ML, Forde OH: Physical activity improves the metabolic risk profiles in men and women. Arch Intern Med 1998, 158:1633-1640.

70. Tiffany N Hilton, Lori J Tuttle, Excessive Adipose Tissue Infiltration in Skeletal muscle in individuals with Obesity , Diabetes mellitus, and Peripheral Neuropathy: Association With Performance and Function Phys Ther. 2008November ;88(11):1336-1344.

71. Trott DW, Gunduz F, Laughlin MH, Woodman CR: Exercise training reverses age-related decrements in endothelium-dependent dilation in skeletal muscle feed arteries. J Appl Physiol 2009, 106:1925-1934.

72. Tully MA, Cupples ME, Chan WS, McGlade K, Young IS: Brisk walking,fitness and cardiovascular risk: a randomized controlled trial in primary care. Prev Med 2005, 41:622-628.

73. Turcotte LP, Fisher JS. Skeletal muscle insulin resistance: Role of fatty acid metabolism and exercise. Phys Ther. 2008;88:1279-1296

74. William E. Kraus, Kraus, MD and Benjamin D. Levine, MD, Combined aerobic and resistance training best for people with Diabetes , the medical news, 18 September 2007

75. Wilson PW, D'Agostino RB, Sullivan L, Parise H, Kannel WB: Overweight and obesity as determinants of cardiovascular risk: the Framingham experience. Arch Intern Med 2002, 162:1867-187

76. Wood R Reyes R. Matthew lee . medicine and science in sports

77. You T, Berman DM, Ryan AS, Nicklas BJ: Effects of hypocaloric diet and exercise training on inflammation and adipocyte lipolysis in obese postmenopausal women. J Clin Endocrinol Metab 2004, 89:1739-1746.

APPENDICES

APPENDIX -1 (ASSESSMENT FORM)

NAME:

AGE:

SEX:

ADDRESS:

GROUP:

MEASUREMENT: Lipid profile

S.no	TEST	LDL	HDL	VLDL	Triglycerides	TOTAL
1.	PRE Value					
2.	POST Value					

APPENDIX 2

INFORMED CONSENT TO PARTICIPATE IN THE RESEARCH STUDY

I _____ voluntarily consent to participate in the research study **"Effect of eccentric resistance training with aerobic exercise on lipid profile in younger adults"**

The researcher has explained me about the exercise approach in brief, the risk of participation and has answered the questions related to the research to my satisfaction.

Signature of the applicant: **Signature of the researcher:**

Signature of the witness: